

U.S. Department of Veterans Affairs Enterprise Reference Terminology Strategic Overview

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Abstract

The Veterans Health Affairs (VHA) branch of the Department of Veterans Affairs has undertaken an Enterprise Reference Terminology (ERT). VHA, arguably the largest integrated healthcare provider in the United States, has completely computerized virtually all clinical transactions, including physician orders and documentation. The VA is now integrating its clinical records across hundreds of sites of care by means of a Health Data Repository (HDR) project. ERT has been designed to provide a terminology development environment, terminology services, and maintenance services for the clinical and business content in HDR and other VHA applications. Drug, laboratory observations, and clinical document title files have been developed, and the ERT will encompass all HDR domains by 2008. Commercial tools are used to host the VHA's ERT terminology development and server environments. We will select and adopt both open-source and licensable terminology systems to provide ERT content, as well as reuse existing VA-specific terminology content.

Keywords:

Vocabulary, Controlled; Information Storage and Retrieval; Information Theory

Background

In fiscal year 2002, the Department of Veterans Affairs (VA) Veterans Health Administration (VHA) provided health care to 4.5 million veterans and dependents in the form of 46.5 million outpatient visits, 564,000 inpatient admissions, and 167 million prescriptions (as 30-day equivalents). VHA has developed and deployed a variety of electronic tools to assist clinicians, including VistA (Veterans Integrated Service and Technology Architecture) [1, 2], CPRS (Computerized Patient Record System) [3, 4], BCMA (Bar Code Medication Administration) [5, 6], and others. All clinical patient records in VHA are now entered electronically by clinicians, including physician orders, notes, problem lists, etc. The paper chart is a mostly historical, vestigial remnant at VA medical centers, and new centers are being built in many cases without medical record storage areas.

To accomplish and continually improve medical records documentation, improve care quality, promote patient safety, and re-

duce costs, VHA is continually looking for ways to use information technology and other tools. As a national healthcare system, VHA also actively seeks to promote data standardization and comparability. Reference terminologies and terminology services permit retrospective and real-time aggregation, and sophisticated decision support. A reference terminology is a formal terminology where each term has a computer-usable formal definition supporting data aggregation and retrieval. Such formal terminologies promise to reduce maintenance and mapping effort [7, 8]. VHA's initial reference terminology project was NDF-RT [9, 10], a formalization of the original VHA National Drug File. VHA has now committed to enterprise wide data standardization in the form an Enterprise Reference Terminology (ERT). The ERT will provide high quality, maintainable, computationally comparable, and re-usable terminology to the VA Information Technology enterprise.

This paper provides a high-level overview of VHA Enterprise Reference Terminology (ERT) architecture plan and implementation strategy.

Enterprise Reference Terminology Mission, Vision, and Goals

The Enterprise Reference Terminology is designed to provide high quality, computationally comparable, and re-usable terminology to the Veterans Affairs Information Technology enterprise. The ERT is being integrated into all VHA enterprise applications in order to provide comparable and computable data between systems and organizational levels. Specific project goals include:

1. Rapid and reliable terminology services to support VistA applications such as Lab, Pharmacy, Text Integration Utilities, Health Data Repository (HDR), and other systems as prioritized by VHA architects and managers.
2. Robust, rapidly responsive maintenance environment for updates, targeting one-day turnaround.
3. Harmonize terminology content and services with open standards whenever possible.
4. Collaborate with government, academic and industry partners to advance standards.

5. Build upon incremental successes domain by domain.
6. Use methods of continuous quality improvement based on Plan-Do-Study-Act (PDSA) cycles.

Rationale for Enterprise Reference Terminology

The ERT is designed to provide 1) comparable and computable data for the VA enterprise, 2) timely maintenance, and 3) consistent terminology services and programming interfaces. VistA was successful partly because it accommodated local flexibility in system configuration and data dictionaries. While this strategy encouraged adoption and implementation, the resulting non-comparable data among VistA sites has made data “rollups”, data comparisons, and data migrations between systems very difficult. For example, a patient seen at multiple sites of care (e.g., several VA sites, a Department of Defense site, or other healthcare partners) cannot have drug interaction checking computed on all their prescriptions across the sites. Truly comparable and computable data would mean that the equivalence or similarity of clinical drugs prescribed across the sites could be precisely determined by the computer system without human intervention. ERT is designed to provide these features. The second problem, Terminology maintenance, has been problematic and must be addressed. VistA terminology development is currently spread among many development teams. These teams do not use standardized tools and advanced methods, and they partly duplicate each other’s work. For example, the VistA Allergy package has its own terminology for allergic reactants that overlaps with the Pharmacy National Drug File. The ERT plan will redirect this existing duplicative terminology maintenance effort by employing new tools to coordinate subject matter experts, and thereby better support VHA’s mission. Finally, ERT is designed to address the current non-standardized and inconsistent terminology APIs in VistA. Unlike many existing kernel services, VistA programmers now contend with a hodge-podge of techniques to access ‘authoritative’ terminologies. In some instances, the terms are hard coded into the M application code. In other cases, terms are referenced from globals within the application. A small number of applications rely on VistA Lexicon Utility terminology services. The first two options offer little or no advanced terminology support. The latter has a limited scope and does not have a maintenance model that accommodates frequent and timely updates.

Proposed Solution

The VHA ERT will use advanced terminology tools and architectures to deliver comparable, computable data to the enterprise. The three major functional areas of ERT are terminology content creation, maintenance and services.

The VHA ERT team first comprehensively assessed existing terminology development tools, and selected the Apelon Terminology Development Environment (TDE) as the best tool set currently available. The Apelon TDE provides a centralized, replicated database that stores loaded and mapped terminologies. A central “chief editor” partitions new terminology items (either initial loads of entire terminology systems or maintenance updates) for distribution to multiple subject matter experts

who construct and review term definitions. The content development schema for ERT domains is detailed in Figure 1.

In addition to creating terminology content where needed, VHA currently acquires and maintains terminology licenses to meet various business and clinical content needs, including the Systematized Nomenclature of Medicine (SNOMED), Current Procedural Terminology (CPT), Unified Medical Language System (UMLS), Laboratory Observations and Identifier Numeric Codes (LOINC), and others. Some of these licenses are cost free while others entail licensing fees. The ERT tool set allows these licensed or open source standards to be integrated with the VHA developed content in a consistent terminology development environment.

Responsive and accurate terminology maintenance is a critical success factor for ERT-supported applications. In contrast to outdated current approaches, modern terminology tools supporting the ERT can provide computer-based support for these activities. Maintenance activities for VA created content are handled through the Apelon terminology development environment, which supports dividing maintenance tasks by domain into work assignments for particular subject matter experts. Maintenance changes can come from terminology vendors, standards development organization updates, field requests, and from application developers. The TDE can directly populate the enterprise’s production terminology servers from the SME’s work.

The VA Terminology Server environment is currently supplied by the Apelon Distributed Terminology Server (DTS). The DTS “services” provide a standard way to distribute the terms when requested by enterprise applications and a central point for terminology maintenance, updates, and harmonization. The terminology services provided in ERT should greatly reduce the currently large number of Database Integration Agreements (DBIA) required for individual applications to access terminology. These services will be scaled to meet existing needs and growing needs as VHA applications are re-engineered. VHA is actively engaged in monitoring marketplace developments in terminology services, including the CorbaMed Terminology Query Services, HL-7’s proposed Centralized Terminology Services, the evolving LDAP proposal from Mayo Clinic, and others. As VHA monitors these developments it will evaluate new standards and existing services in terms of the following criteria: transaction speed, load balancing, scalability, update methods, the extent of supported terminology services, and the number and size of existing implementations.

The ERT is being now being phased into production in three ways that maximize its positive effects and minimize costs. First, terminology content has been prioritized by “domain”. Reference terminologies are being designed [9, 10] to meet specific needs and requirements. The prime customer for the ERT is the VA’s Health Data Repository project. Using a Plan-Do-Study-Act approach [11] incremental deployment of ERT into this and other VHA business processes is planned over the next 5 years (2003-2008).

Issues for Consideration

Scaling Terminology Development & Maintenance

Scalability of terminology development is affected by several factors including the ability of the TDE to effectively coordinate, distribute, track, and integrate workload amongst subject matter experts. TDE software must permit distributed, collaborative term definition or it will not scale to the task. Clear term definition guidelines are also important for effective collaborative work. Kaiser-Permanente's CMT project's term definition guidelines are an excellent example to follow. Scalability is also affected by the speed of a component of the TDE known as the "classifier". Classifiers employ different algorithms and permissible logical operations, and so have different performance characteristics. Also, characteristics of the terminology model (e.g. the existence of logical 'partitions') being classified affect classification performance. Scalable maintenance of terms also requires mechanisms to publish content changes from information suppliers (such as FDA) into the TDE, and thence into production terminology servers. In our NDF-RT drug domain, the highest rate of change is the NDC product level at approximately 4000 updates per month. We anticipate that a good portion of routine maintenance (e.g. adding another NDC level drug with an already defined set of ingredients) can be automated via a series of electronic transactions. Updates requiring changes to underlying reference taxonomies will get closer supervision from subject matter experts.

Scaling Terminology Servers

Terminology servers operate on a transactional basis. VHA is now planning a comparison of terminology server capabilities on a standardized series of transactions. Terminology servers should be able to be configured to operate in a distributed way—either via the server software, operating system, or front-end routing device. Servers should run on commodity hardware with an operating system that VA has sufficient expertise to maintain. The comparison will assess server performance when workload is to be divided evenly across domains (e.g. lab, pharmacy, and diagnoses), or specialized within a particular domain (e.g. labs only), and other combinations. The role of local term caches and adequate network capacity will be evaluated. Maintenance issues also influence deployment of terminology services, requiring a functional system to publish changes from the Commercial Off The Shelf (COTS) terminology tools to production terminology servers. Clearly, a set of servers will need to remain in production while others are updated to provide uninterrupted service. Network loads and properly skilled employees to oversee the technical aspects of the update process are potential risk factors. A very rough order of magnitude estimate of update size for the NDF RT domain (ca. 200,000 items) is 140Mb per complete update.

Intellectual Property

VHA intends to own, or license on acceptable terms, the intellectual content of the ERT in order to safeguard access to our data into the future. Chapter 5 of the Federal Record Retention Requirements statute compels VHA to preserve access to its medical records, electronic or paper, for 75 years after the pa-

tient's death. Therefore VHA must address intellectual property before purchasing or licensing any controlled health vocabulary. Therefore, a realistic plan to access coded data after license expiration or cancellation must be created prior to utilizing any third-party vocabulary. This plan must respect legal data retention requirements and give practical consideration to the useful lifespan of specific data elements. Intellectual property issues must also be addressed regarding terminology mappings. Mapping of local VA terms to unencumbered terminologies must become the property of the government. Also, contracts for mappings to encumbered terminologies should be treated with the same care as for the terminologies themselves. Finally, any tool used for terminology services or terminology development should be demonstrably capable of exporting content in a common format, such as XML.

Enterprise Terminology Scope

VHA intends to use reference terminology when indicated by: 1) a need for comparable data between sites or other organizational units (e.g., data roll ups, data transfers, site comparison, national decision), 2) dynamically changing content, 3) when maintenance costs are high or turnaround times are critical, 4) when coordination and synchronization between terminologies and developers is needed, and 5) whenever the terminologies are large and complex. Reference terminologies need not be used for simple code sets (e.g. "yes – no"). As suggested by ANSI-HISB & CPRI, VHA is striving to achieve a series of interlocking, inter-related domain-specific reference terminologies, rather than a single monolithic system.

Role of Standards

VHA ERT will adopt open standards whenever possible, and attempt to advance standards that are marginally sufficient. When no standards exist, ERT will offer its solutions for others to reuse. Implicit in this is collaboration with other government agencies, academia, and industry. This approach is consistent with the VHA's *HealthePeople* strategy.

Summary

The VHA ERT strategy is designed to provide high quality, computationally comparable, re-usable terminology to our applications. The strategy calls for existing VHA subject matter experts to use COTS terminology development tools and existing terminologies whenever appropriate to create, integrate, and maintain content relevant to VHA's mission. Terminology services will provide enterprise applications with centrally maintained, high quality, consistent terminology. This represents a major step towards improving data quality and comparability. The ERT is designed to become VHA's anchor point for other government terminology efforts such as those at FHIE, *HealthePeople*, Centers for Disease Control, Food and Drug Administration, and the National Library of Medicine. The ERT will be an essential technology to reduce the risk and increase the chance of success for VHA's Health Data Repository project, Pharmacy re-engineering initiative, and other future applications. Most importantly, the ERT will substantially improve patient care and

patient safety in VHA by providing high quality terminology services for improved decision support.

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